(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 910 543 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
17.04.2002 Bulletin 2002/16

(21) Application number: **97924633.7**

(22) Date of filing: **09.05.1997**

(51) Int Cl.[7]: **C01B 7/19**, C07C 17/38

(86) International application number:
PCT/US97/07842

(87) International publication number:
WO 97/43208 (20.11.1997 Gazette 1997/50)

(54) **PROCESS FOR HYDROGEN FLUORIDE SEPARATION**

VERFAHREN ZUR WASSERSTOFFFLUORIDABTRENNUNG

PROCEDE DE SEPARATION DU FLUORURE D'HYDROGENE

(84) Designated Contracting States:
DE ES FR GB IT NL

(30) Priority: **10.05.1996 US 644546**

(43) Date of publication of application:
28.04.1999 Bulletin 1999/17

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Description

Field of the Invention

[0001] The present invention relates to a method for separating hydrogen fluoride from a chemical mixture. More specifically, a method is provided for separating hydrogen fluoride from a chemical mixture containing hydrogen fluoride by contacting the chemical mixture with a hydrogen fluoride binder.

Background of the Invention

[0002] Hydrogen fluoride is widely used in industry for a variety of processes including in fluorocarbon and fluoropolymer manufacture, in alkylation reactions, and in fluorine manufacture. In these processes, it is desirable to separate the hydrogen fluoride from the other reactants, products, and impurities. However, hydrogen fluoride can be difficult to separate. This is especially true in fluorocarbon manufacture because hydrogen fluoride forms an azeotropic mixture with many fluorocarbons.

[0003] A number of methods have been developed in order to separate hydrogen fluoride from chemical mixtures. The known methods include the use of sodium fluoride, alkaline earth compounds, carbon molecular sieves, water-immisicible amines, oleum, distillation, membranes, and electrodialysis to facilitate separation of the hydrogen fluoride. Each of the known methods is disadvantageous in that these processes are inefficient, uneconomical, or produce a toxic waste stream.

[0004] Additionally, United States Patent No. 5,458,674 discloses a process for separating hydrogen fluoride from a mixture of hydrocarbons and hydrogen fluoride by adsorbing or absorbing hydrogen fluoride onto a fluorinated polymer.

[0005] This process is disadvantageous in that only 10 to 15 weight percent of hydrogen fluoride based on the weight of the polymer can be adsorbed or absorbed before the polymer must be regenerated.

[0006] U.S. Patent No. 4, 640, 831 discloses a process for recovering protic acids, including hydrofluoric acid, from a medium. The process uses a reversible base that is an aromatic compound with one or more nitrogen atoms in an aromatic ring or a polymer with pendant aromatic compounds with one or more nitrogen atoms in an aromatic ring. the disclosed process is disadvantageous in that high temperatures are required for recovery of the hydrogen fluoride.

[0007] U.S. 5,458,674 discloses a process for separating hydrogen fluoride from organics by passing a mixture through a bed containing a polymer which absorbs the hydrogen fluoride and recovering the hydrogen fluoride from the polymer.

[0008] Therefore, a need exists for a hydrogen fluoride separation method that attempts to overcome the disadvantages of the prior art methods.

Description of the Invention and Preferred Embodiments

[0009] This invention provides a continuous, intermittent, or batch process for separating hydrogen fluoride from a hydrogen fluoride-containing chemical mixture. The process of the invention provides a convenient and cost-effective method for separating hydrogen fluoride.

[0010] The process of the invention comprises contacting a first chemical mixture containing hydrogen fluoride with a hydrogen fluoride binder under conditions suitable to separate hydrogen fluoride from the first chemical mixture to produce a second chemical mixture in which the amount of hydrogen fluoride is reduced, wherein the hydrogen fluoride binder comprises a synthetic water-soluble polymer wherein the synthetic water-soluble polymer is acrylamide polymer, acrylic acid polymer, ethylene oxide polymer, methacrylic acid polymer, polyethyleneimine polymer, polyvinyl alcohol polymer, polyvinyl pyrrolidone polymer or mixtures thereof. The process may also provide for recovering the hydrogen fluoride from the binder for reuse and regeneration of the binder.

[0011] It is to be understood that separating includes both isolating hydrogen fluoride from a mixture as well as purifying the hydrogen fluoride by removing impurities from the hydrogen fluoride. Further, for purposes of this invention, a chemical mixture is a liquid or vapor phase mixture of inorganic material, organic material, or mixtures thereof. Illustrative inorganic materials include, without limitation, hydrogen, hydrogen chloride, sulfur dioxide, sulfur trioxide, carbon monoxide, carbon dioxide, boron trifluoride, uranium hexafluoride, sulfur hexafluoride, arsenic pentafluoride, halide salts, nitric acid, sulfuric acid, chlorine, metal ions, non-aqueous inorganic solvents, and mixtures thereof. Exemplary organic material includes, without limitation, halocarbons such as chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbon, and perfluorocarbons, chlorocarbons, hydrochlorocarbons, hydrofluoroethers, fluoroethers, hydrocarbons, and mixtures thereof.

[0012] The process of the invention may be carried out in any suitable corrosion resistant vessel. In the process of the invention, a first chemical mixture containing hydrogen fluoride is contacted with a hydrogen fluoride binder for at least about 0.1 seconds, more preferably from about 0.1 to about 100,000 seconds, still more preferably from about 1 to about 10,000 seconds, and most preferably from about 2 to about 100 seconds. The hydrogen fluoride binder of the invention may be any polymer capable of reversibly binding hydrogen fluoride. Preferably the polymer is inert, or substantially inert, to hydrogen fluoride. For purposes of this invention, polymer may be a homopolymer, copolymer, or mixtures thereof.

[0013] Generally, the polymers used in the invention have molecular weights of from about 5,000 to about 10,000,000. Preferably, polymers with molecular

weights of from about 5,000 to about 1,000,000 are used. The polymers used as binders in the invention are water-soluble polymers. By "water-soluble polymer" is meant any high molecular weight compound that swells, to about twice its dry volume, or dissolves with the addition of water at room temperature.

[0014] Illustrative synthetic water-soluble polymers include, without limitation, polymers, related polymers, and polymer salts of acrylamide, acrylic acid, ethylene oxide, methacrylic acid, polyethyleneimine, polyvinyl alcohol, polyvinyl pyrrolidone, and mixtures thereon. By related polymer is meant that the polymer repeat unit, or a branch thereof, is extended by carbon atoms, preferably from one to four carbon atoms. For example, a related polymer of acrylic acid is one in which the vinyl group is extended by one carbon to form an allyl group.

[0015] Preferably, polyacrylic acid or one of its salts is used. Most preferably, the water-soluble polymer is sodium polyacrylate.

[0016] The polymer may be selected in order to separate hydrogen fluoride alone. Alternatively, it may be selected so as to separate hydrogen fluoride and any other material from the chemical mixture.

[0017] The form of the binder, such as liquid or solid, may be tailored for use with the process that produces the chemical mixture. The amount of binder used will depend on the specifics of the process producing the chemical mixture. Such specifics include, without limitation, the quantity of hydrogen fluoride to be separated from the first chemical mixture, the desired frequency of binder regeneration, the acceptable content of hydrogen fluoride in the second chemical mixture, the flow rate of the first chemical mixture, and the absorption characteristics of the polymer. Generally, the amount of binder used will be an amount effective to separate the desired amount of hydrogen fluoride from the first chemical mixture.

[0018] In one embodiment of the invention, the binder is in the form of particles, fibers, or a shaped piece or pieces and the binder is placed in a vessel to form a packed bed of binder. The first chemical mixture is contacted with the binder by passing the mixture through the column in order to separate hydrogen fluoride from the mixture to produce a second chemical mixture that has a reduced hydrogen fluoride content. Generally, contacting may be performed at the temperature at which the first chemical mixture was formed. More particularly, contacting is performed at temperatures less than about 200° C, preferably at less than about 150° C, more preferably at less than about 120° C, and most preferably at less than about 100° C. Contacting may be performed at any pressure, but preferably is performed at atmospheric or superatmospheric pressure.

[0019] The performance of the binder may be improved by periodically regenerating the binder to release the hydrogen fluoride separated from the first chemical mixture. Regeneration may be accomplished by subjecting the binder to a reduced pressure, including a vacuum, to release hydrogen fluoride vapor which may be then recovered by any convenient means such as a cold trap. Alternatively, the binder may be subjected to a vacuum and temperatures from about 0° C to about 200° C, preferably from about 80° C to about 125° C, to speed the release of hydrogen fluoride vapor. As yet another alternative, the binder may be heated in the presence of a gas or solvent capable of carrying the hydrogen fluoride to another part of the process. The gases useful in this embodiment are any gases that are inert to the hydrogen fluoride and polymer including, without limitation, air, nitrogen, helium, and argon. In cases in which the binder is being used as a part of a chemical process the hydrogen fluoride and gas may be returned to the process or the hydrogen fluoride vapor isolated.

[0020] The amount of hydrogen fluoride bound to the binder must be controlled in order to maintain the mechanical integrity of the binder. If the binder is in solid form, allowing the amount of hydrogen fluoride separated from the first chemical mixture and bound by the binder to reach a level at which the binder turns from a solid into a gel or liquid may be disadvantageous. The amount of hydrogen fluoride at which this phase change occurs will vary depending on the binder used. Generally, when the separated hydrogen fluoride makes up about 80 weight percent, based on the combined weight of the binder and the separated hydrogen fluoride, the binder will be a viscous liquid. Binders with less than about 80 weight percent hydrogen fluoride will be gel-like solids. Preferably, binding of hydrogen fluoride is carried out up to the amount at which a phase change occurs. Hydrogen fluoride separation and binding may be monitored by any convenient means as for example, measuring the amount of hydrogen fluoride in the chemical mixtures or maintaining the temperature of the binder bed at a point at which the polymer cannot bind sufficient hydrogen fluoride to undergo a phase change. Further, if one or more other chemicals in the first chemical mixture forms a gel or solid with the binder, the hydrogen fluoride absorption required for the solid to liquid phase change may be altered.

[0021] The process of the invention may include recovering the separated hydrogen fluoride from the binder. The hydrogen fluoride may be recovered from the binder by first applying heat, applying a vacuum, using a stripping gas or solvent, or any combination thereof. The hydrogen fluoride removed from the binder by the heating or vacuum is then condensed by cooling. Generally, the higher the temperature, the higher is the vapor pressure of hydrogen fluoride above the binder vapor pressure and the less vacuum and cooling will be required to condense the hydrogen fluoride. Temperatures are determinable by one ordinarily skilled in the art by a consideration of the binder used. Generally, temperatures from about 0° C to about 200° C, preferably from about 80° C to about 125° C, are used.

[0022] If the process of the invention is used in a continuous mode and it is desirable to recover the hydrogen

fluoride from the binder, preferably, at least two binder beds are employed in order to provide that at least one binder bed is continuously available while hydrogen fluoride is being recovered from the other bed. Additionally, if very low levels of hydrogen fluoride are desired in the second chemical mixture, that mixture may be treated sequentially with more than one binder bed to reach the desired hydrogen fluoride level. Alternatively, the process of the invention may be used in conjunction with one of the well known hydrogen fluoride separation methods.

[0023] The invention will be clarified further by a consideration of the following examples that are purely exemplary.

Examples

Example 1

[0024] 7.0 g of sodium polyacrylate, m wt 1,000,000, were placed in a PFA cylinder, the cylinder evacuated and 27.6 g HF added. The cylinder was shaken for 1 hour. All of the HF was absorbed by the sodium polyacrylate. The PFA cylinder was then heated to 105° C to drive off the HF, which was recovered in an attached Monel cylinder cooled in a liquid nitrogen bath. 25.4 g HF were recovered.

Example 2

[0025] Cylinder A, a 150 cc Monel cylinder, was charged with 4.0 g sodium polyacrylate, m wt 1,000,000, and evacuated. A mixture of 4.0 g HF and 75.7 g chlorodifluoromethane, HCFC-22, was distilled into cylinder A. Cylinder A and its contents were then placed on a mechanical shaker for 30 minutes and, subsequently, vented into an evacuated 1,000 cc ice-cooled cylinder, cylinder B During the venting step, cylinder A lost 72.7 g of material to cylinder B. The contents of cylinder B were mixed with water and titrated. Cylinder B contained 0.26 g HF and 72.44 g HCFC-22. Cylinder A was then heated at about 100° C and 5.6 g material were evolved. The material was collected and analyzed and found to be 2.76 g HF and 2.76 g HCFC-22. A gas chromatogram of the collected HCFC-22 was identical to that of the starting material indicating that no decomposition occurred.

[0026] Example 2 demonstrates that sodium polyacrylate preferentially mixes with HF rather than HCFC-22 and, thus, contacting a mixture of HF and HCFC-22 with sodium polyacrylate separates hydrogen fluoride from the mixture.

Example 3

[0027] The procedure of Example 2 was used except that 5.0 g sodium polyacrylate, m wt 1,000,000, 78.2 g CFC-12 and 5.0 g HF were substituted for the sodium polyacrylate, HCFC-22 and HF, respectively, of Example 2. Cylinder A, when vented, lost 75.7 g that was analyzed and found to be 0.75 g HF, 74.98 g CFC-12. Upon heating cylinder A to approximately 100° C, 3.8 g HF and 2.4 g CFC-12 were recovered.

Example 4

[0028] A mixture of 26.6 g 1,1,1,3,3-pentachloropropane, HCC-240, and 1.6 g HF was added to a PFA cylinder containing 1.8 g sodium polyacrylate, m wt 1,000,000. The mixture was shaken for 1 hour and 22.1 g of liquid decanted from the resulting gel-like solid. The liquid was washed with water, phase separated and analyzed which demonstrated that it contained 0.01 g HF and 22.0 g organic. Heating the gel-like solid at approximately 100° C for 1 hour released 2.1 g of material that was collected in an evacuated cylinder and analyzed as 1.06 g HF and 1.04 g organic.

Example 5

[0029] The procedure of Example 4 was used except that 1.6 g sodium polyacrylate, m wt 1,000,000, 24.8 g HCFC-141b, and 1.3 g HF were substituted for the sodium polyacrylate, HCC-240 and HF of Example 4. 21.5 g of liquid were decanted from the gel-like solid. The liquid was analyzed and found to be 0.01 g HF and 21.4 g organic. Heating the gel-like solid at 100° C drove 3.8 g of material from the gel that was analyzed and found to be 0.33 g HF and 3.47 g HCFC-141b.

Example 6

[0030] The procedure of Example 4 was used except that 1.5 g sodium polyacrylate, m wt 1,000,000, 25.6 g C_2Cl_4 and 1.3 g HF were substituted for the sodium polyacrylate, CC-240 and HF of Example 4. 21.0 g of liquid were decanted from the gel that was analyzed and found to be 0.004 g HF and 21 g C_2Cl_4. Heating of the gel at 100° C recovered an additional 3.6 g of material that was determined to be 0.52 g HF and 3.08 g organic.

Example 7

[0031] The procedure of Example 2 was used except that 1.1 g sodium polyacrylate, m wt 1,000,000, 22.4 g isobutane and 1.0 g HF were substituted for the sodium polyacrylate, HCFC-22 and HF of Example 2. 22.1 g of material was not absorbed by the polymer and was vented after the 1 hour of shaking. This material was analyzed and found to be 0.07 g HF and 22.03 g organic. Heating the remaining material at approximately 100° C for 1 hour released 1.1 g of material that was analyzed and found to be 0.47 g HF and 0.63 g organic.

Example 8

[0032] The procedure of Example 2 was used except that 1.7 g sodium polyacrylate, m wt 1,000,000, 16.8 g octafluoropropane, FC-218, and 1.7 g HF were substituted for the sodium polyacrylate, HCFC-22 and HF of Example 2. 15.6 g of material was not absorbed by the polymer after shaking and was vented from the cylinder. This vented material was analyzed as 0.03 g HF and 15.57 g organic. Heating of the material in Cylinder A at approximately 100° C for 1 hour released 2.2 g of material that was analyzed and found to be 0.81 g HF and 1.4 g organic.

Example 9

[0033] The procedure of Example 2 was used except that 7.5 g sodium polyacrylate, m wt 1,000,000, 20.0 g 1,1,1,3,3-pentafluoropropane, HFC-245fa, and 6.5 g HF were substituted for the sodium polyacrylate, HCFC-22 and HF of Example 2. After shaking the mixture, the cylinder was vented and lost 20.0 g of material that was analyzed and found to be 0.5 g HF and 19.5 g HFC-245fa.

Example 10

[0034] The procedure of Example 4 was used except that 1.6 g sodium polyacrylate, m wt 1,000,000, 19.4 g tetrahydrofuran and 1.7 g HF were substituted for the sodium polyacrylate, CC-240 and HF of Example 4. 18.5 g of material did not form a gel after 1 hour of shaking and was decanted from the vessel. This liquid was analyzed and found to be about 1.4 g HF. An additional 1.2 g material were released when the gel was heated at approximately 100° C for 1 hour and found to be mainly tetrahydrofuran.

Example 11

[0035] The procedure of Example 2 was followed except that 1.62 g sodium polyacrylate, m wt 1,000,000, 0.1 g H_2 and 1.66 g HF were substituted for the sodium polyacrylate, HCFC-22 and HF of Example 2. After 1 hour of shaking, the cylinder was vented and 0.1 g of material was lost. The vented material contained 0.015g HF. Heating the cylinder at approximately 100° C for 2.5 hours released 0.3 g of material that contained 0.17 g HF.

Example 12

[0036] 30.0g of sodium polyacrylate, m wt 1,000,000, were placed in a vessel and 50.0 g of a 1 weight percent HF /99 weight percent HCl mixture were passed over the sodium polyacrylate in a 15 minute period. The collected gas had 3 to 5 times less HF than the starting mixture.

Example 13

[0037] The procedure of Example 2 was followed except that a mixture of 27.5 g HCFC-22, 21.0 g HCl, and 1.5 g HF was distilled into a cylinder charged with 1.5 g sodium polyacrylate, m wt 1,000,000. After shaking the mixture for 1 hour, the cylinder was vented and lost 46.1 g that was analyzed and found to be 26.6 g HCFC-22, 0.3 g HF and 22.5 G HCl. Heating the remaining gel at approximately 100° C for 2 hours liberated 0.9 g HF, 1.2 g HCl and 0.1 g HCFC-22.

Example 14

[0038] The procedure in Example 2 was followed except that 1.6 g sodium polyacrylate, m wt 1,00,000, 20.4 g HCFC-22, 1.5 g HF and 21.3 g CO_2 were substituted for the sodium polyacrylate, HCFC-22 and HF , respectively, of Example 2. After shaking the mixture for 1 hour, the cylinder was vented and lost 41.4 g of material containing 0.18 g HF. Heating of the gel at approximately 100° C released 1.7 g of material that contained 1.0 g HF.

Example 15

[0039] The procedure of Example 6 was used except that 1.5 g poly(acrylic acid-co-maleic acid)sodium salt, m wt 50,000, 1.8 g HF and 25.0 g C_2Cl_4 were used. After 1 hour, 18.2 g of liquid were decanted and found to be 0.002 g HF and 18.2 g C_2Cl_4. Heating of the gel at approximately 90° C for 1 hour drove off about 1.8 g of material, most of which was HF.

Example 16

[0040] The procedure in Example 2 was followed except that 1.8 g NAFION™ NR50, 1.7 g HF and 22.9 g HCFC-22 were used. After 1 hour, 24 g of material were not absorbed on the polymer (0.7 g HF and 23.3 g HCFC-220. Heating the polymer at 90° C for 1 hour yielded 0.8 g of material that analyzed as 0.6 g HF and 0.2 g HCFC-22.

[0041] Example 16 demonstrates that the NAFION™ polymer has a lower capacity for separating hydrogen fluoride from a chemical mixture than the binder of Example 2.

Example 17

[0042] The procedure of Example 2 is used except that 7.0 g acrylic acid, m wt 1,250,000, are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g of HF used in the experiment demonstrating the separation of HF and HCFC-22 with polyacrylic acid.

Example 18

[0043] The procedure of Example 2 is used except that 7.0 g polyacrylate copolymerized with 20 wt percent, 50,000 m wt acrylamide are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g of HF used in the experiment demonstrating the separation of HF and HCFC-22.

Example 19

[0044] The procedure of Example 2 is used except that 7.0 g acrylic acid copolymerized with 10 wt percent, 200,000 m wt acrylamide are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g of HF used in the experiment demonstrating the separation of HF and HCFC-22.

Example 20

[0045] The procedure of Example 2 is used except that 7.0 g of 2,100 m wt sodium polyacrylate are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating liberates essentially all 4.0 g of HF used in the experiment.

Example 21

[0046] The procedure of Example 2 is used except that 7.0 g sodium polyacrylate copolymerized with 10 wt percent, 15,000 m wt methylmethacrylate are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder liberates essentially all 4.0 g of HF used in the experiment demonstrating the separation of HF and HCFC-22 with this polymer.

Example 22

[0047] The procedure of Example 2 is used except that 7.0 g polyethylene oxide, m wt 10,000,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g of the HF used in the experiment demonstrating the separation of HF and HCFC-22.

Example 23

[0048] The procedure of Example 2 is used except that 7.0 g polymethacrylic acid, m wt 2,500,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Example 24

[0049] The procedure of Example 2 is used except that 7.0 g polymethacrylamide, m wt 250,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Example 25

[0050] The procedure of Example 2 is used except that 7.0 g polyvinyl alcohol, m wt 500,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Example 26

[0051] The procedure of Example 2 is used except that 7.0 g polyvinyl pyrrolidone, m wt 50,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Example 27

[0052] The procedure of Example 2 is used except that 7.0 g polyethyleneimine, m wt 750,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Example 28

[0053] The procedure of Example 2 is used except that 7.0 g polyacrylamide, m wt 10 0,000 are substituted for the sodium polyacrylate of Example 2. When cylinder A is vented to cylinder B, all of the HCFC-22 and only a trace of the HF are measured in cylinder B. Heating cylinder A liberates essentially all 4.0 g HF used in the experiment.

Claims

1. A process for separating hydrogen fluoride from a chemical mixture comprising contacting a first chemical mixture containing hydrogen fluoride with a hydrogen fluoride binder to separate hydrogen fluoride from the first chemical mixture to form a second chemical mixture with a reduced content of hydrogen fluoride, wherein the hydrogen fluoride binder comprises a synthetic water-soluble polymer wherein the synthetic water-soluble polymer is acrylamide polymer, acrylic acid polymer, ethylene oxide polymer, methacrylic acid polymer, polyethyleneimine polymer, polyvinyl alcohol polymer, polyvinyl pyrrolidone polymer or mixtures thereof.

2. The process of claim 1 wherein the hydrogen fluoride binder is sodium polyacrylate.

3. The process of claim 1 further comprising the step of regenerating the hydrogen fluoride binder at a temperature of from about 80°C to about 125°C to release separated hydrogen fluoride.

4. The process of claim 1 further comprising the step of recovering the separate hydrogen fluoride from the binder at a temperature of from about 80°C to about 125°C.

5. The process of claim 1 wherein the chemical mixture is a mixture of inorganic material.

6. The process of claim 1 wherein the chemical mixture is a mixture of organic material.

7. The process of claim 6 wherein the organic material is hydrofluorocarbons, hydrochlorofluorocarbons, perfluorocarbons, chlorofluorocarbons, or mixtures thereof.

8. The process of claim 1 wherein contacting is performed at less than about 150°C.

Patentansprüche

1. Verfahren zur Abtrennung von Fluorwasserstoff aus einem Chemikaliengemisch, bei dem man ein erstes, Fluorwasserstoff enthaltendes Chemikaliengemisch mit einem Fluorwasserstoff-Bindemittel zur Abtrennung von Fluorwasserstoff aus dem ersten Chemikaliengemisch unter Bildung eines zweiten Chemikaliengemischs mit verringertem Fluorwasserstoffgehalt in Berührung bringt und als Fluorwasserstoff-Bindemittel ein synthetisches wasserlösliches Polymer einsetzt, bei welchem es sich um Acrylamid-Polymer, Acrylsäure-Polymer, Ethylenoxid-Polymer, Methacrylsäure-Polymer, Polyethylenimin-Polymer, Polyvinylalkohol-Polymer, Polyvinylpyrrolidon-Polymer oder Gemische davon handelt.

2. Verfahren nach Anspruch 1, bei dem man als Fluorwasserstoff-Bindemittel Natriumpolyacrylat einsetzt.

3. Verfahren nach Anspruch 1, bei dem man ferner das Fluorwasserstoff-Bindemittel bei einer Temperatur von etwa 80°C bis etwa 125°C unter Freisetzung von abgetrenntem Fluorwasserstoff regeneriert.

4. Verfahren nach Anspruch 1, bei dem man ferner den abgetrennten Fluorwasserstoff bei einer Temperatur von etwa 80°C bis etwa 125°C aus dem Bindemittel zurückgewinnt.

5. Verfahren nach Anspruch 1, bei dem man als Chemikaliengemisch ein Gemisch aus anorganischem Material einsetzt.

6. Verfahren nach Anspruch 1, bei dem man als Chemikaliengemisch ein Gemisch aus organischem Material einsetzt.

7. Verfahren nach Anspruch 6, bei dem es sich bei dem organischen Material um teilhalogenierte Fluorkohlenwasserstoffe, teilhalogenierte Chlorfluorkohlenwasserstoffe, Perfluorkohlenwasserstoffe, vollhalogenierte Chlorfluorkohlenwasserstoffe oder Gemische davon handelt.

8. Verfahren nach Anspruch 1, bei dem man das Inberührungbringen unterhalb von etwa 150°C durchführt.

Revendications

1. Procédé de séparation du fluorure d'hydrogène d'un mélange chimique, comprenant la mise en contact d'un premier mélange chimique contenant du fluorure d'hydrogène avec un liant de fluorure d'hydrogène, pour séparer le fluorure d'hydrogène du premier mélange chimique, afin de former un deuxième mélange chimique, ayant une teneur réduite en fluorure d'hydrogène, **caractérisé en ce que** le liant de fluorure d'hydrogène comprend un polymère synthétique hydrosoluble dans lequel le polymère synthétique hydrosoluble est constitué par un polymère d'acrylamide, un polymère de l'acide acrylique, un polymère de l'oxyde d'éthylène, un polymère de l'acide méthacrylique, un polymère du polyéthylèneimine, un polymère d'alcool polyvinylique, un polymère de la polyvinylpyrrolidone ou des mélanges de ces derniers.

2. Procédé selon la revendication 1, **caractérisé en ce que** le liant de fluorure d'hydrogène est le polyacrylate de sodium.

3. Procédé selon la revendication 1, comprenant en outre l'étape de régénération du liant de fluorure d'hydrogène à une température allant d'environ 80EC à environ 125EC pour libérer le fluorure d'hydrogène séparé.

4. Procédé selon la revendication 1, comprenant en outre l'étape de récupération du fluorure d'hydrogène séparé du liant à une température allant d'environ 80EC à environ 125EC.

5. Procédé selon la revendication 1, **caractérisé en ce que** le mélange chimique est un mélange de matériau inorganique.

6. Procédé selon la revendication 1, **caractérisé en ce que** le mélange chimique est un mélange de matériau organique.

7. Procédé selon la revendication 6, **caractérisé en ce que** le matériau organique est constitué d'hydrofluorocarbones, d'hydrochlorofluorocarbones, de perfluorocarbones, de chlorofluorocarbones ou de mélanges de ces derniers.

8. Procédé selon la revendication 1, **caractérisé en ce que** la mise en contact est effectuée à une température inférieure à environ 150EC.